

REMARKS

In the Official Action of August 10, 2004, claims 1-27, 35, 37-39, 41, 43 and 162-170 have been finally rejected under 35 U.S.C. 103(a) as being obvious over Fuller et al. (USP 5,998,185; "Fuller '185") or WO 94/16058 ("WO '058"), in view of Williams, et al. (USP 6,245,537 B1), Mikos et al. (USP 5,514,378) and Fuller (WO 97/08291; "Fuller WO"). This ground of rejection is respectfully traversed.

Prior to discussing the rejection, applicants would like to take this opportunity to summarize the present invention, and to place the cited references in some perspective.

The present invention is directed to a method of making a three-dimensional porous silicone rubber structure which can be used as a scaffold for growing cells or tissue. The structure is formed by mixing a sacrificial filler with a silicone rubber precursor, curing the mixture below 180°C, and removing the sacrificial filler. The three-dimensional structure thus formed contains a network of interconnecting porous channels throughout the structure. See pages 5 and 23 of the present specification.

The Fuller et al. (Fuller '185) and WO '058 references both relate to porous silicone rubber structures which are formed by the aeration of uncured silicone rubber. These references, which are based on a common application, disclose porous silicone rubber structures formed by aerating silicone rubber. The density of the silicone rubber can be increased through the use of additives, such as stainless steel powder. This provides a relatively dense rubber structure. Alternatively, the porosity of the structure may be increased by aerating the rubber structure during its manufacture.

The Examiner concedes that these references fail to disclose the use of a sacrificial additive for increasing the porosity of the rubber structures as required in the present claims. As stated in the instant specification, a sacrificial additive is one which is intimately mixed with the structure, and is later removed by dissolution. In fact, the use of a sacrificial additive of any type is inconsistent with the disclosure in these references which teach the use of aeration of the material while in liquid form. The only additive disclosed in the references is steel powder which

is used for the purpose of increasing density. Accordingly, one skilled in the art, confronted with the problem of increasing porosity of a structure, would be taught to use aeration rather than a sacrificial additive for porosity enhancement.

Williams et al. discloses the formation of porous polyhydroxyalkanote (PHA) articles using, for instance, a sacrificial filler followed by leaching the material in a solvent. The process of Williams et al. involves melting the polymer prior to the addition of salt particles, or other sacrificial fillers, to form a liquefied polymer mixture, which is then cooled to form a solidified PHA. The salt particles are removed from the solidified polymer by dissolution. PHA is known to be a polymer with a relatively low melting point.

The porous articles formed according to the Williams et al. process are relatively thin membranes which can be used as tissue scaffolds. As disclosed in the reference, the membranes are designed to be further processed to prepare other articles, such as to form tubes or heart valves. These membranes are relatively thin, two-dimensional articles, and not three-dimensional structures of the present invention.

The Mikos et al. patent discloses the preparation of porous articles from biocompatible polymers. The articles are prepared by dissolving the polymer in a solvent, and adding a sacrificial filler to this solution. The solvent is evaporated, and the polymer is suitably processed to provide the desired degree of polymer crystallinity. The filler particles are leached from the polymer to provide a porous structure.

The types of articles contemplated in Mikos et al. are relatively thin membranes and films. Thicker, three-dimensional structures can be formed from these membranes, but only as a result of the mechanical lamination of the relatively thin structures. There is no disclosure in Mikos et al. that three-dimensional structures can be formed by leaching a sacrificial filler from the polymer.

The Fuller WO reference discloses a method for forming textured silicone rubber surfaces on roller bottles. In Fuller WO, a silicone precursor coating is formed on an internal surface of the roller bottle, and particles of a sacrificial filler material are embedded in the surface of the silicone rubber precursor material. The precursor is then cured, and the filler is removed by dissolution.

The Examiner states that it would be obvious to modify the porous silicone rubber support structures disclosed in the Fuller '185 or WO '058 references by adding filler particles to a silicone rubber precursor, and leaching the particles as taught by Williams et al. and Mikos et al. The Examiner further states that both of the Fuller et al. references disclose the idea of controlling the porosity of the coating by including an additive during formation of the silicone rubber structure.

In response, applicants maintain that the individual teachings of the references are not compatible, and that one skilled in the art would not combine these teachings in the manner proposed by the Examiner in the Office Action. Further, there would be no motivation for one skilled in the art to combine the references as suggested by the Examiner.

Neither the Williams et al. nor the Mikos et al. references disclose the formation of a three-dimensional porous structure as is the case in the present application. Rather, the processes described in these references result in creating pores on the surface portion only of the thin membranes described therein. The sacrificial fillers used in these references can be readily removed by dissolution since the fillers are present on the surface of the membranes. In contrast, the fillers of the present invention are deeply embedded in the polymer matrix by mixing these components to create, upon removal, an interconnecting network of porous channels throughout the three-dimensional structure. This procedure, and the resultant porous structural configuration, are not disclosed in the prior art.

The process described in the Mikos et al. reference requires a curing step which is not part of applicants invention. If one skilled in the art were to follow the express teachings of this reference, and apply those teachings to the silicone rubber precursor materials of this invention, the result would be to dissolve the silicone rubber precursor in a solvent, thereby producing a silicone rubber precursor solution. If this solution were mixed with particles of a sacrificial filler, the individual particles would become encased by the solution. This is not the case when the particles are mixed with the silicone rubber precursor as set forth in the present claims. The encasement of the individual filler particles means that the particles are completely coated with the precursor solution. Upon curing of the silicone rubber, the particles would be not be capable

of dissolution and removal from the polymer, and the formation of a three-dimensional porous structure would not be achieved.

Moreover, there is also no reason to believe that the Mikos et al. process could be successfully used with silicone rubber precursor polymers. Thus, following the express teachings of Mikos et al., one skilled in the art would not use the process disclosed in the reference with silicone polymer precursor materials since this would not result in the preparation of porous structures of the type claimed in the present application.

Similarly, the Williams et al. reference uses a PHA polymer which is completely different, in terms of physical and chemical properties, from the silicone polymer of the present invention. The method disclosed in the reference would not work with silicone polymers since it is not possible to melt silicone rubber at elevated temperatures and then recrystallize the polymer by reducing the temperature, as taught in the reference.

The criteria for the selection of a sacrificial filler that is operable in the present invention is disclosed on page 7, line 24 to page 8, line 3 of the instant specification, which also describes the problems associated with other materials commonly used as sacrificial fillers. The fillers of this invention must be carefully selected to avoid interaction of the filler and the silicone rubber, due to the intimate contact of these materials during the polymerization process. The Williams et al. and Mikos et al. references do not recognize this problem since, in the processes disclosed in those references, the filler is not in contact with the polymer when it is undergoing polymerization. Accordingly, it is evident that the filler selection criteria is not mentioned or even recognized in the prior art.

Claims 1-27, 34, 35, 37-39, 41 and 43 have been rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-33 of Fuller, 185, in view of Williams et al., Mikos et al. and Fuller '185 or WO '058. This ground of rejection is traversed.

Applicants traverse this rejection, essentially for reasons of record with respect to the traversal of the obviousness rejection as discussed above. The Fuller '185 patent discloses only the use of aeration to increase the porosity of silicone rubber articles, and there is no sound

factual basis for combining this reference with the secondary references as asserted in the Office Action.

In view of the foregoing considerations, the claims of this application are now believed to overcome all remaining rejections, and to be in condition for allowance. Accordingly, reconsideration and withdrawal of the rejections is solicited, and allowance of the pending claims of this application is requested. The Examiner is invited to contact the undersigned if this would advance the prosecution of this application.

Respectfully submitted,

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